The keynote to success depends upon the early recognition of the condition and immediate operation. The only reliable symptoms to be recognized in time to forestall the rapidly impending disaster are pain and muscular rigidity. Pain occurring during the course of typhoid should always be suspected as an indication of probable perforation without regard to its locality. I operated one case where the pain was originally in the glans penis and there remained for several hours. This man had a perforation and died, because the location of the pain so entirely threw us off of the track that by the time we had recovered the patient's sun had sunk beneath the horizon.

PROTOZOA IN THE STOMACH AND THEIR DIAGNOSTIC SIGNIFICANCE.

By John Benjamin Nichols, M.D.,
of Washington, D. C.

A recent finding of protozoa in the stomach attracted attention to this subject, and examination of the literature showed such a surprisingly small number of similar cases reported that the matter is deemed worthy of presentation.

My case was that of a white man, clerk, born in Virginia, aged thirty-five years, who entered Garfield Hospital, Washington, D. C., March 16, 1905, in the service of Dr. G. Wythe Cook, to whom I am indebted for the opportunity of reporting it. The family and previous personal history were irrelevant.

The patient had suffered from chronic indigestion for fourteen years, with attacks of vomiting, occasional epigastric pain, etc. During the last few months the dyspeptic symptoms had become worse, his food disagreeing more and more. For the past five months he had been unable to belch or vomit. He had never vomited blood. Constipation was marked. Latterly the pain had become constant and some difficulty in swallowing had developed.

At the time of admission to the hospital he was much emaciated and extremely pallid. Palpation yielded a sense of resistance in the epigastrium. Temperature subnormal. Blood: red cells, 4,680,000; hæmoglobin, 80 per cent.; leukocytes, 7800. Urine examination negative.

The stomach tube, passed March 20th, an hour after an Ewald test meal, encountered slight obstruction, easily overcome, at the cardiac orifice. About 15 c.c. of material was obtained, of extremely fetid odor, thick and viscid, the first portion colorless, the last portion containing much stale blood, and with necrotic fragments present. The different portions of the material gave the impression of having come from separate loculi or recesses in the stomach. The reaction was alkaline; a trace of rennet was present; acids, starch, erythrodextrin, sugar, and distinguishable food material were absent. An immediate, rather hurried microscopic examination of the necrotic fragments showed these to consist of granular detritus in which were present large numbers of actively moving flagellate protozoa, apparently trichomonads. Unfortunately, a more careful examination to determine the presence of other flagellates or protozoa was not made.

The patient returned to his home March 25, and died March 27, 1905.

A clinical diagnosis was made of carcinoma of the stomach involving the cardiac region and anterior wall, and without pyloric obstruction.

A thorough search of the literature down to the beginning of the year 1905 has enabled me to find only 22 cases recorded of protozoa in the stomach, reported by eight observers, as follows:

Osler,	1895	1 case.
Hensen,	1897	1 "
Strube,	1898	1 "
Zabel,	1901 and 1904	4 cases.
Ullmann,	1902	1 case.
Cohnheim,	1903	5 cases.
Schmidt,	1904	3 "
Rosenfeld,	1904	6 "

These, with my case, make a total of 23 cases.

As to the varieties of protozoa found, flagellates were present in every case, with associated amœbæ in a few instances. The chief organisms were trichomonas intestinalis and lamblia intestinalis (megastoma entericum). In most of the cases only a single species occurred; in a few, two or more varieties were simultaneously or consecutively present. The occurrence of the species in the 23 cases was as follows:

Trichomonas alone	12 cases.
Lamblia alone	5 "
Flagellates, undetermined	1 case.
Trichomonas and lamblia	1 "
Lamblia, trichomonas, amœbæ, and unknown forms	1 "
Trichomonas and amœbæ	2 cases.
Trichomonas, amœbæ, and "monads"	1 case.
	23

The number of cases in which each variety occurred was:

Trichomonas	17 cases.
Lamblia	7 "
Flagellates, undetermined	1 case.
"Monads"	1 "
Amœbæ	4 cases.
Unknown protozoa	1 case.

The morbid conditions existing in the stomach in the cases in which these protozoa were found were:

Chronic gastritis	2 cases.
Gastric ulcer	1 case.
Carcinoma of stomach	19 cases.
Undiagnosticated	1 case.

Two of the cases were diagnosticated chronic gastritis. In Osler's case the only record is the brief statement that he had seen trichomonas in the vomitus in a case of chronic gastric catarrh. In Rosenfeld's case, that of an alcoholic male, aged forty-four years, there had been dyspeptic symptoms for seven years, and achylia and gastroptosis existed; trichomonads were found for a time in the fasting stomach contents, and also in carious teeth; the patient improved greatly, and as he was under observation for sixteen months without cancerous developments the diagnosis of chronic alcoholic gastritis was regarded as assured.

In the case of gastric ulcer (Schmidt), that of a female aged thirty years, lamblia intestinalis was abundant in the stomach contents, which contained 0.4 per cent. of hydrochloric acid (corresponding to the high acidity of 110). Study of the case warranted a sure diagnosis of ulcer and excluded that of cancer.

In the undiagnosticated case (Zabel), that of a male aged forty-one years, there were achylia and general symptoms, but as the patient was only once observed a definite diagnosis was not arrived at. It may have been cancer.

Of the 19 cancer cases, 15 occurred in men, 1 in a woman, in 3 the sex was not stated. The ages ranged from thirty-five to sixty-nine years. The diagnosis was verified by operation in one case, by autopsy in two cases, and was based on clinical conditions only in fourteen cases, no details in two cases. Achylia was present in all the cases giving particulars excepting one, in which after test meal the total acidity was 37, free hydrochloric acid 6. In some of the cases the parasites were discovered in the advanced stages of the disease, when the diagnosis was perfectly obvious. In others, however, they were found very early, in association with such indefinite symptoms as achylia, digestive disturbance, etc.; they have been observed even before the appearance of cachexia, and often months before the tumor became palpable. They have been found as early as six weeks after the advent of symptoms, and as long as thirteen, fourteen, and twenty-four months before death. Two of the cases (Zabel) were rather benign at the time of finding the parasites (adenoma or papilloma); one of these was cured by gastrectomy; in the other after a year's interval of great improvement and freedom from symptoms the malignant conditions recurred and steadily progressed.

In none of the 17 cancer cases in which details are given was obstruction or stenosis, with stagnation or motor insufficiency, present at the time when the parasites occurred. In no case was the neoplasm situated in the pyloric region, or if the pylorus was involved there was no stenosis. In a notably large proportion of the cases the lesions were located at the cardia, involving also the lower end of the œsophagus.

In nearly all the cases the material examined was obtained by the tube, and usually from the fasting stomach. The fluid containing the protozoa was usually of alkaline or at least neutral reaction, fetid odor, rather thick consistency, and contained blood. It often contained small fragments, either particles of mucous membrane or tumor tissue, necrotic flakes, or masses of bacteria and leptothrix filaments; and in these fragments the parasites were especially apt to be found. Food remnants were usually absent. In some cases, however, there was no fetid odor, and in some there was no blood. The reaction was the most important and significant characteristic, being alkaline or neutral in every instance in which details are given excepting one, Schmidt's case of ulcer, in which, indeed, the fluid was hyperacid. In two of Rosenfeld's cases there was an acidity after test meals of 37 and 6 respectively, but the protozoa were found in the alkaline or neutral fasting contents, the supposition being that in the stomach the parasites were embedded in alkaline mucus in recesses of the stomach wall protected from contact with the acid contents.

In three of the cases the trichomonas was found also in the patients' carious teeth; and in many of them the various protozoa were found also in the feces. These findings suggest that the parasites may have originally found their way to the stomach from the mouth, from bronchiectatic sputum, or backward from the intestine. As Skaller and others have suggested, flagellates in the stools may in some cases be derived from colonies in gastric or œsophageal carcinomatous growths.

Besides these 23 cases of protozoa in the stomach, there are 2 cases of carcinoma of the œsophagus recorded in which protozoa were similarly found. In Irisawa and Takiguchi's case circomonas intestinalis was found in foul material of acid reaction (from lactic acid fermentation) regurgitated from the œsophagus in a man aged sixty-two years. In Cohnheim's case, that of a man aged fifty-four years, trichomonads and amœbæ were found in œsophageal washings nine weeks after the advent of symptoms.

To look for protozoa in the stomach, the material, preferably removed in the fasting condition, should be examined under the microscope immediately while still fresh and warm; or it should be kept at body temperature until the examination can be made. Cooling checks the activity of the organisms and makes their detection difficult and uncertain, and too great delay even if kept warm may cause them to disintegrate and disappear. Fetid bloody alkaline or neutral gastric fluid is to be regarded as especially apt to contain the parasites; and if solid masses or fragments are present, these particularly should be examined.

Cases of protozoa in the stomach are probably not so rare as the paucity of the recorded cases would indicate. They are not found because they are not expected and not looked for systematically or in a proper way. The facts that observers who have been on the lookout have within short periods found 6, 5, 4, and 3 cases each, and that 12 cases, over half the entire number recorded, were reported during the year 1904, after attention had been directed to the subject, shows that cases will probably be found much more frequently than in the past if proper and systematic search for them is made.

So far as the data at hand enable us to judge, some tentative conclusions may be derived as to the conditions which render possible and favor the residence of protozoa in the stomach, an organ which is normally antagonistic to the presence of living organisms. Two conditions are regarded as, if not essential, at least highly important for their development in this viscus, namely, a non-acid medium and suitable recesses in the stomach wall.

While the trichomonas vaginalis thrives in acid vaginal mucus, and the trichomonas found by Dock and others in the urinary organs grew in acid urine, the trichomonas and other flagellates that inhabit the alimentary passages seem there to prefer an alkaline or neutral medium. It is therefore in cases of achylia, and especially in cases where the gastric contents are rendered alkaline by mucus or blood, that the colonization of protozoa in the stomach is favored. The reason why these parasites are not found in the stomach in cases of pyloric carcinoma with stenosis seems to be that in these cases the lactic acid developed by fermentation in the stagnant stomach inhibits their development. The possibility of their occurrence in acid media is, however, shown by Schmidt's remarkable hyperacid ulcer case, also in the œsophageal case of Irisawa and Takiguchi.

The presence of small recesses, pockets, or diverticula in the stomach wall, favoring the residence therein of protozoa, is regarded as another important condition for the presence of the parasites in the stomach. The fact that protozoa have been found especially in tissue fragments and other solid flakes in stomach contents points to the favoring conditions for their colonization afforded by recesses in solid tissues. These recesses afford harborage for the parasites, and protect them from the gastric acids and from being flushed out of the stomach by the food and drink. Such recesses are most apt to occur in connection with carcinomatous or papillomatous conditions, from ulceration, the growth of spongy tufts with intervening recesses, etc. The absence of such recesses in chronic gastritis perhaps may account for the very infrequent finding of the parasites in this disease, although a non-acid medium is afforded by it as well as by cancer. It is possible that in the gastritis cases the parasites may be located under folds of atrophied gastric mucosa. Further observations are, however, still needed to show whether in simple gastritis with achylia the conditions are in general inimical to the residence of protozoa in the stomach.

A final estimate as to the diagnostic significance of the presence of protozoa in the stomach cannot be formed until more extensive series of observations are properly made, with both negative and positive findings, not only in cancerous but also in non-cancerous conditions, and especially in non-carcinomatous cases of achylia gastrica. The opinion at first expressed by Cohnheim and others that the condition is pathognomonic of cancer is no longer entirely tenable. So far as we can judge from the data at hand, however, the presence of the parasites appears to be strongly indicative of the existence of non-pyloric, or at least of non-obstructive, carcinoma of the stomach. As out of 23 cases 19 and probably 20 were carcinomatous, the numerical probability of the existence of cancer in any case presenting protozoa in the stomach is on this basis about 7 to 1. The significance of their presence depends entirely on the fact that they indicate the existence of the conditions requisite to their development; and as non-obstructive cancer of the stomach affords the precise conditions required, the occurrence of the parasites is accordingly significant of this disease. The kind of protozoan present is immaterial, and absence of the parasites has no diagnostic bearing whatever. While they have not been many times found in the past, it is probable that they may be found more frequently if properly and systematically looked for. Since the parasites may appear very early in the course of gastric carcinoma, they may constitute, in the cases where they are detected, another aid to early diagnosis, so that their diagnostic value may be greatly enhanced by the fact that it may be of service at a time when operative procedures can still be resorted to with hope of curative results.

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